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Solar UV irradiation-induced production of N_2O from plant surfaces - low emissions rates but all over the world.

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Nitrous oxide (N_2O) is an important long-lived greenhouse gas and precursor of stratospheric ozone depleting mono-nitrogen oxides. The atmospheric concentration of N2O is persistently increasing; however, large uncertainties are associated with the distinct source strengths. Here we investigate for the first time N_2O emission from terrestrial vegetation in response to natural solar ultra violet radiation. We conducted field site measurements to investigate N_2O atmosphere exchange from grass vegetation exposed to solar irradiance with and without UV-screening. Further laboratory tests were conducted with a range of species to study the controls and possible loci of UV-induced N_2O emission from plants. Plants released N_2O in response to natural sunlight at rates of c. 20-50 nmol m^{-2} h^{-1}, mostly due to the UV component. The emission rate is temperature dependent with a rather high activation energy indicative for an abiotic process. The prevailing zone for the N_2O formation appears to be at the very surface of leaves. However, only c. 26% of the UV-induced N_2O appears to originate from plant-N. Further, the process is dependent on atmospheric oxygen concentration. Our work demonstrates that ecosystem emission of the important greenhouse gas, N_2O, may be up to c. 30% higher than hitherto assumed.

Literature:

Mikkelsen TN, Bruhn D & Ambus P. (2016). Solar UV Irradiation-Induced Production of Greenhouse Gases from Plant Surfaces: From Leaf to Earth. Progress in Botany, DOI 10.1007/124_2016_10.

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